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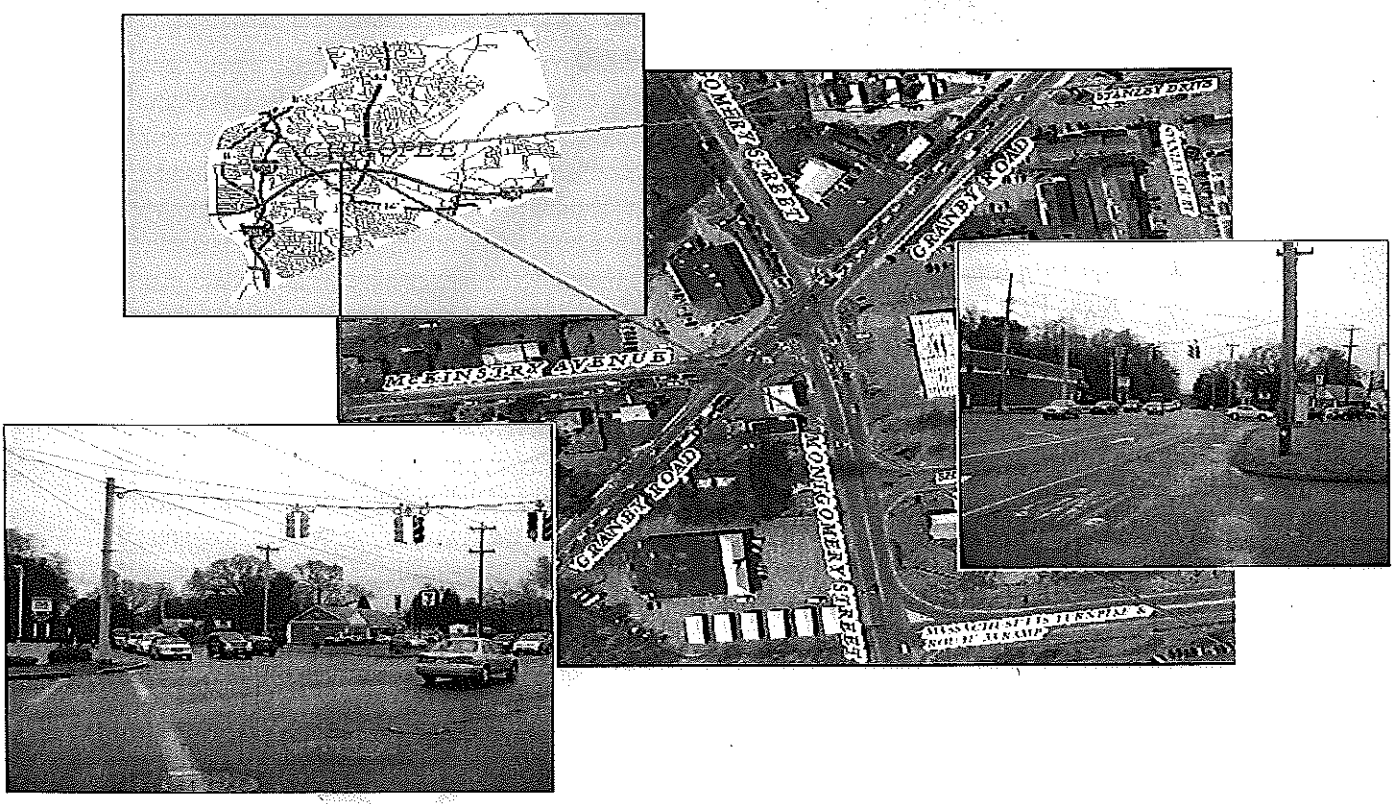
TRANSPORTATION AND SAFETY STUDY

GRANBY ROAD, MONTGOMERY STREET AND McKINSTRY AVENUE INTERSECTION

CHICOPEE



PREPARED UNDER THE DIRECTION OF PIONEER VALLEY MPO BY:
PIONEER VALLEY PLANNING COMMISSION
26 CENTRAL STREET
WEST SPRINGFIELD, MA 01089

APRIL 2009

Prepared in cooperation with the City of Chicopee, the Executive Office of Transportation and Public Works, the Massachusetts Highway Department and the U.S. Department of Transportation - Federal Highway Administration and the Federal Transit Administration. The views and opinions of the Pioneer Valley Planning Commission expressed herein do not necessarily state or reflect those of the U.S. Department of Transportation.

Catalyst for Regional Progress
PVPC
Pioneer Valley Planning Commission

ABBREVIATIONS

1	AM, a.m.	Afore Meridian
2	Av.	Avenue
3	LOS	Level of Service
4	MassHighway	Massachusetts Highway Department
5	MPH	Miles per Hour
6	MUTCD	Manual on Uniform Traffic Control Devices
7	PM, p.m.	Post Meridian
8	PVPC	Pioneer Valley Planning Commission
9	Rd.	Road
10	St.	Street
11	TMC	Turning Movement Counts

The Massachusetts Turnpike (I-90) Exit 5 access road intersects Montgomery Street approximately 600 feet south of the intersection. A second access road which serves a large retail area is also located approximately 350 feet south of the intersection.

The intersection is served by two existing crosswalks, one across Montgomery Street north of the intersection and a second across Granby Road west of the intersection. No pedestrian traffic signals are provided at this intersection. Curbing in the vicinity of the intersection is in poor to fair condition. Pavement is in poor condition at some locations and pavement markings have faded at several locations.

COMMERCIAL DEVELOPMENT IN THE VICINITY

There are several retailers and businesses in vicinity of the intersection. *CVS* pharmacy is located on the northwest corner of the intersection. The entrance to the pharmacy is located on the Montgomery Street approach about 200 feet from the intersection. The curb opening is more than 30 feet wide and there is a painted hatched block marked on the pavement with 'Do Not Block' markings on both sides. A *'7-11'* is located on the northeast corner of the intersection. The *'7-11'* has a total of three curb openings: one entrance is located on Montgomery Street while the other two curb openings are located on Granby Road.

The southeast corner of the intersection is occupied by a *Sunoco* Gas Station and *Walgreens* Pharmacy. Internal access is unrestricted between the *Sunoco* and *Walgreens*. *Walgreens* has two entrances on Granby Road. These openings are well defined with distinct pavement markings and 'Stop' signs. The opening nearer the intersection has a median separating the entering and the exiting lanes. *Sunoco* has two entrances on Montgomery Street. 'Do Not Block' pavement markings with a painted hatched block are located in front of the southern most opening.

Another gas station, *Racing Mart,* is located on the southwest corner of the intersection. Two curb openings provide access and egress from this gas station. One opening is located on Montgomery Street and other is located on the Granby Road where traffic from McKinstry Avenue and Granby Road merges.

South of the intersection on Montgomery Road is an access road to the Fairfield Shopping Plaza. A hatched block with 'Do Not Enter' markings is also painted in front of this entrance.

MONTGOMERY STREET

It is a two lane highway classified as urban major collector U5. It is almost aligned in north-south direction and connects Prospect Street to the north and MA Route 141 and MA Route 33 to the south. Massachusetts Turnpike I-90 Exit 5 access road intersects Montgomery Street to the south of its intersection with Granby Road. The pavement of Montgomery Street near t0he intersection is in poor condition and pavement markings have faded. A sidewalk is along western side of the street. North of the intersection, Montgomery has two travel lanes. The right lane is designated for right turning and through traffic; and left lane is designated for left turning and through traffic. Both the lanes are well defined by pavement markings.

South of the intersection, Montgomery Street provides three travel lanes. The right lane is designated for right turning traffic, center lane for through traffic and left lane for left turning traffic. The pavement of the approach is in bad condition and there are many visible distresses and pot holes. The pavement markings for the right lane are faded and not clearly visible. The posted speed limit for the street is 30 mph.

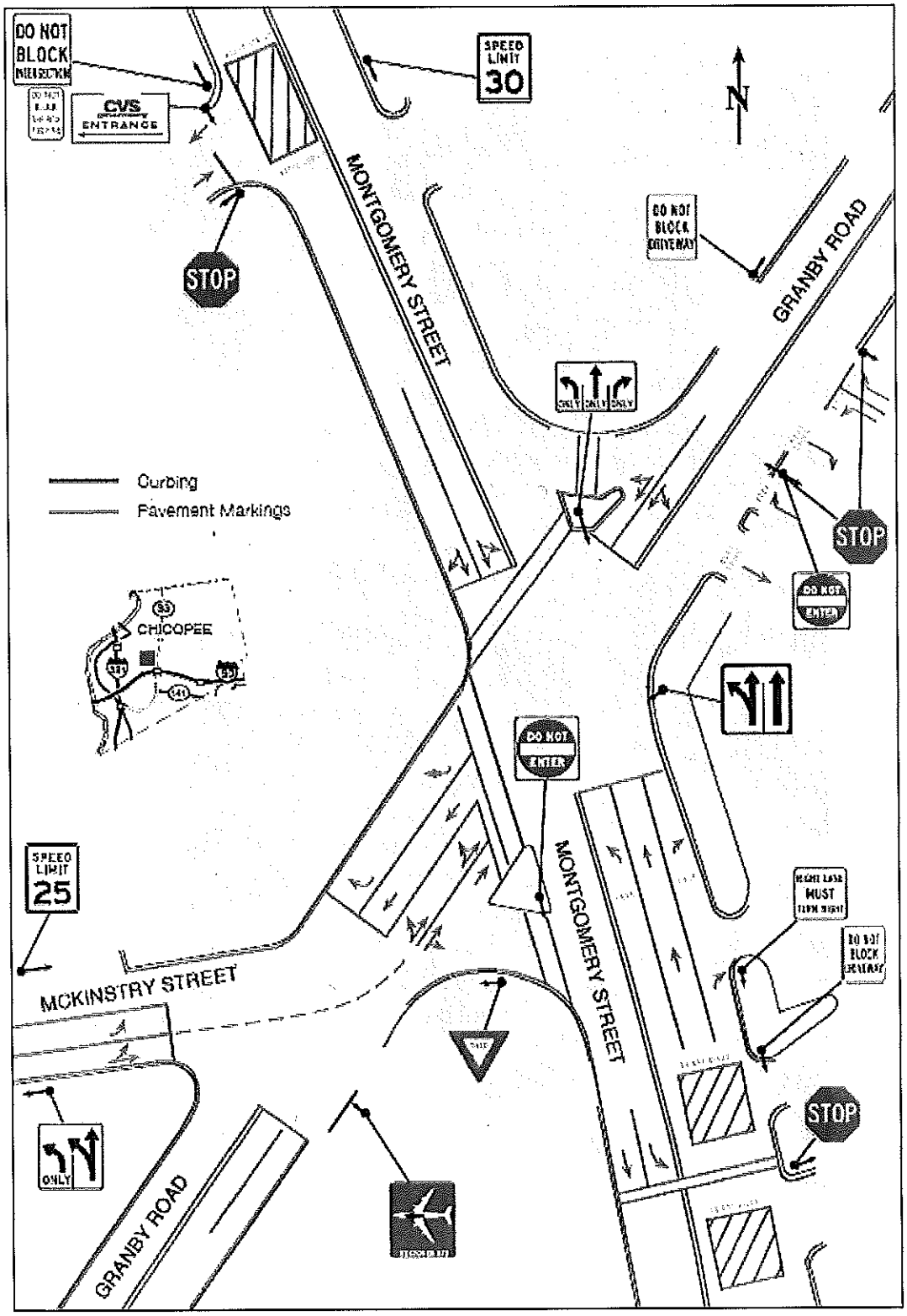
The driveway for the *Fairfield Shopping Plaza* does not have any curbing and so there is considerable damage to the pavement edges. There are no pavement markings and the 'Stop' sign is mounted at a low height.

GRANBY ROAD

Granby Road is also a two lane urban collector U5 aligned in northeast-southwest direction connecting Route 33 to Route 116. Sidewalks are provided on both sides of Granby Road east of the intersection and on the northern side of the road west of the intersection. The posted speed limit is 30 mph. Boston Bay Pizza is located on the southern side of Granby Road and western side of Montgomery Street. The driveway for Boston Bay Pizza on Granby Road has been sealed using cones and ropes. This helps reduce conflicts between the vehicles at the intersection of Granby Road with McKinstry Avenue.

At its intersection with McKinstry Avenue, Granby Road provides two travel lanes. These lanes are not defined by any signs or pavement markings. West of Montgomery Street, Granby Road provides three travel lanes. The left lane is

Figure 3: Existing Pavement Markings and Signage



Prepared by the Pioneer Valley Planning Commission, February 2009. Illustration is not to scale.

II. EXISTING TRANSPORTATION CONDITIONS

This section provides a technical evaluation of the transportation components for the intersection. It includes a presentation of the data collected, analysis of traffic operations, and a series of observations and conclusions derived from the analysis.

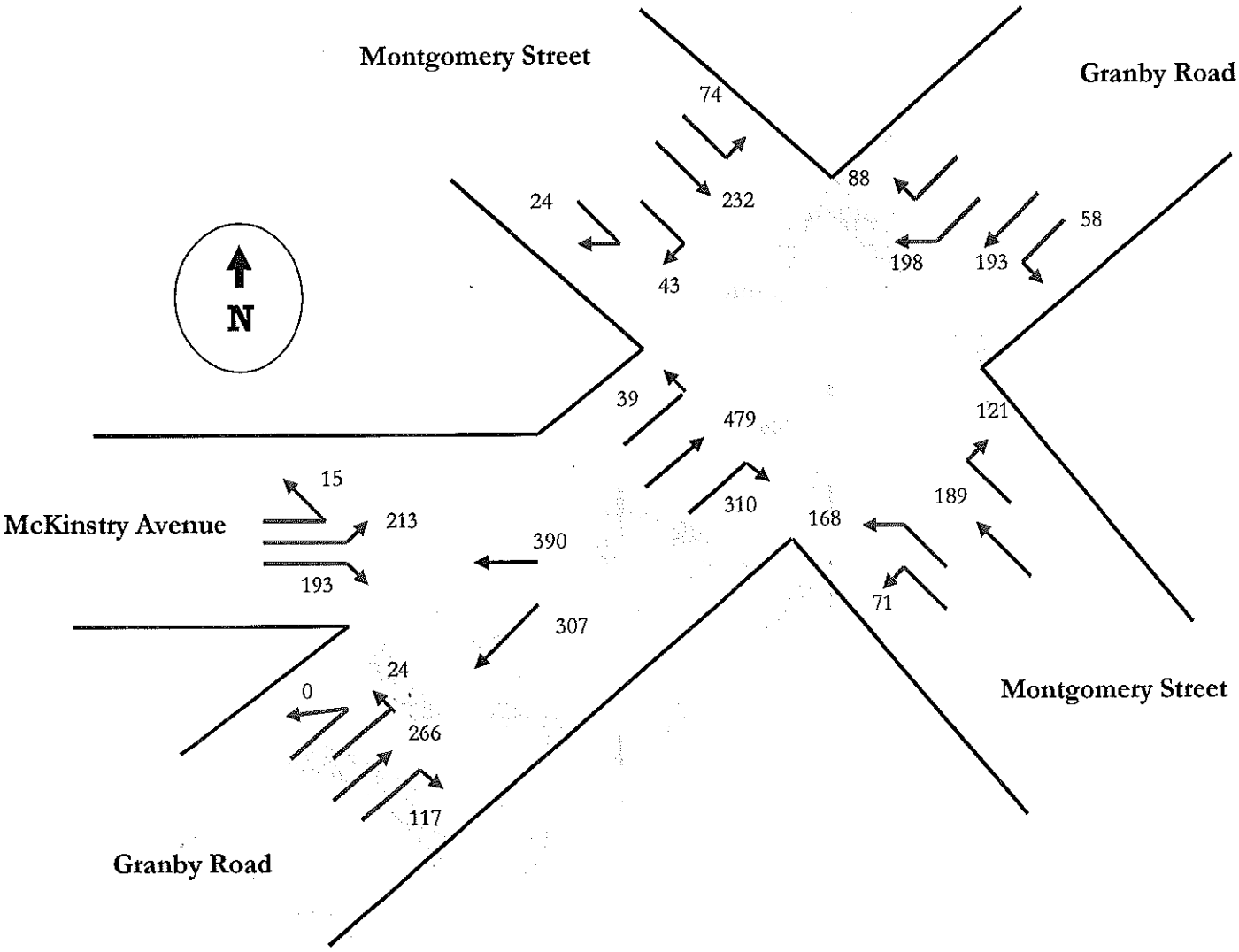
PEAK HOUR VOLUME AND TURNING MOVEMENT COUNTS

Turning Movement Counts (TMC's) were conducted for the intersection during the peak commuter periods. The weekday peak commuter period occurs during the morning hours of 7:00 AM to 9:00 AM and the afternoon hours of 2:00 PM to 6:00 PM for any intersection in the vicinity of a school. The TMC's were conducted to identify the peak four consecutive 15 minute periods of traffic through the intersection. These consecutive peak 15 minute periods constitute a location's Peak Hour Volume. The peak hour of traffic volume represents the most critical period for operations and will be the focus for some of the analysis conducted in this study.

The TMC data also identifies the number of heavy vehicles and pedestrians on the roadway. Heavy vehicles include trucks, recreational vehicles and buses. The percentage of heavy vehicles in the traffic flow is an important component in calculating the serviceability of a corridor or intersection. Trucks impact traffic flow because they occupy more roadway space than passenger cars and have poorer operating capabilities with respect to acceleration, deceleration and maneuverability.

The TMC data were obtained during weekday peak periods. As traffic volumes tend to fluctuate over the course of the year, the Massachusetts Highway Department (MassHighway) develops traffic volume adjustment factors to reflect monthly variations. These factors were examined to determine how traffic conditions at the intersection of Granby Road, Montgomery Street and McKinstry Avenue compare to average monthly conditions.

Afternoon Peak Hour (4:30 p.m. to 5:30 p.m.)



It can be seen from TMC diagrams that all the approaches carry almost equal amounts of traffic. Right turns from McKinstry Avenue onto Granby Road are not permitted. Left turns from Granby Road's northeast bound approach onto McKinstry Avenue are not restricted yet very few vehicles were observed taking this turn during the morning and afternoon peak hours.

SAFETY

To study safety, PVPC obtained the crash history of the intersection from the Massachusetts Highway Department (MassHighway) and the Chicopee Police Department. Actual crash reports were studied and analyzed to form a collision diagram of the intersection. The crash history for calendar years 2004 - 2006 was provided by MassHighway. A total of 13 crash reports were obtained from the Chicopee Police Department for calendar years 2006 to 2008, which helped in formulating the collision diagram.

1. Crash Rate Analysis

A crash rate analysis was performed to compare the crash rate at the intersection to the average value for MassHighway District 2 signalized intersections. The crash rate per million entering vehicles was used for this crash rate analysis. In theory, crash rates can increase as the traffic volume along the roadway increases or as the potential for conflict is increased. The crash rate per million entering vehicles takes into consideration the number of crashes at an intersection and the number of vehicles that enter the intersection over the course of an average day. Based on MassHighway data, the average crash rate for a signalized intersection is 0.94.

For the purpose of calculating a crash rate, both the intersections are considered as one and the volumes entering from all five approaches are summarized. These volumes comprise the total volume entering both the branches of the intersection.

The crash rate for the intersection is 3.0, which is much higher than the average crash rate of 0.94 for signalized intersections in MassHighway District 2. The high differences between the two crash rates could be a result of analyzing the intersection as one large intersection instead of two smaller intersections. It is also reflective of the high volume of traffic conflicting with a high concentration of commercial access drives.

at the intersection of Granby Road with McKinstry Avenue and 9 occurred at the intersection of Granby Road with Montgomery Street. Using the same ratio to break up the other 72 crashes; we get 22 crashes at the intersection of Granby Road with McKinstry Avenue and 50 crashes at the intersection of Granby Road with Montgomery Street.

Using this approximation we can calculate the crash rate at intersection of Granby Road and Montgomery Street as 2.08 and crash rate at the intersection of Granby Road with McKinstry Avenue as 1.27. The crash rates at both the intersections are still much higher than the average value. This means that the intersection has safety issues and some improvements are required to reduce the number of crashes at this location.

2. Collision Diagram

PVPC obtained 13 crash reports from the Chicopee Police Department for the 2006 to 2008 (through October) calendar years. The objective was to analyze the collision patterns and determine factors that may contribute to crashes at this intersection.

Based upon the data in the crash reports, each crash has been depicted graphically in the collision diagram and the pattern of the crash has been identified in the table. Not all the patterns described in the table indicate a traffic violation. Figure 5 shows the collision diagram for the intersection. The details of the crashes shown in the figure are presented in Table 2.

From the collision diagram of the available 13 crash reports different crash patterns can be observed. Crashes number 1 and 5 are sideswipe crashes. Crash number 1 was a result of improper passing by an overtaking vehicle and crash number 5 involved a sideswipe by a large truck with an adjacent car. Crash number 2 occurred when a vehicle trying to enter the *'7-11'* parking lot collided with a through moving vehicle ahead. Crash numbers 3, 4, 6, 9 and 12 were rear end collisions at a red light. Crash number 7 occurred between a through moving vehicle the right of way and a vehicle attempting to cross Montgomery Street from the *CVS* driveway onto the *'7-11'* driveway. Crash numbers 8, 10 and 13 occurred between vehicles with conflicting left turn and through movements on Granby Road. Crash number 11 was a single vehicle crash. The car collided with the light pole on McKinstry Avenue when another car cut across its path exiting out from the *Racing Mart* gas station driveway. Nearly 50% of the crash reported by the Chicopee Police Department involved a personal injury.

Table 2: Crashes included in Collision Diagram

	DATE	TIME	DAY	SEV.	L	R	P		DATE	TIME	DAY	SEV.	L	R	P
1	03/18/06	8:32 PM	SAT	PD	2	4	10	8	01/30/08	7:07 PM	WED	I	3	4	8
2	04/20/06	10:15 PM	THU	PD	3	4	8	9	04/16/08	10:15 AM	WED	I	1	4	5
3	05/12/06	9:13 PM	FRI	I	3	4	5	10	05/15/08	2:33 PM	THU	I	1	4	13
4	03/09/07	2:49 PM	FRI	PD	1	4	5,12	11	07/07/08	2:12 PM	MON	PD	1	4	12
5	06/12/07	8:38 AM	TUE	I	1	4	10	12	08/06/08	11:06 AM	WED	PD	1	4	5
6	10/23/07	11:22 PM	TUE	PD	3	2	5	13	10/14/08	8:27 PM	TUE	I	3	4	8
7	11/21/07	5:57 PM	WED	PD	2	2	13	14							

Source: Chicopee Police Department

Light Condition (L)
1. Daylight
2. Dawn/Dusk
3. Darkness
4. Unknown

Road Condition (R)
1. Dry
2. Wet
3. Snow/Ice
4. Not Known

Pattern (P)

0. Not Known	1. Speed too fast	2. Failure to Yield
3. Ran Stop Sign	4. Ran Traffic Signal	5. Rear End
6. Improper Passing	7. Wrong side of road	8. Improper turning
9. Improper backing	10. Sideswipe	11. Pedestrian violation
12. Human Error	13. Angle	

Fatality	F
Personal Injury	I
Property Damage	PD

indicates forced flow conditions illustrated by long delays and vehicle queues. Level of Service 'C' indicates a condition of stable flow and is generally considered satisfactory in rural areas. Under LOS 'D' conditions, delays are considerably longer than under LOS 'C', but are considered acceptable in urban areas. At LOS 'E' the roadway begins to operate at unstable flow conditions as the facility is operating at or near its capacity.

For the LOS analysis the study area is divided into three separate intersections; *Intersection 1*: Granby Road with McKinstry Avenue; *Intersection 2*: Granby Road with Montgomery Street; and *Intersection 3*: Montgomery Street with Shopping Plaza Driveway. *Intersections 1* and *2* are actuated and coordinated signalized intersections and *Intersection 3* is an unsignalized three legged intersection with the westbound approach of the shopping plaza driveway operating under 'Stop' sign control.

Existing level of service for each approach is shown in Table 4. LOS at all the approaches of *Intersections 1* and *2* ranges from A to D. Maximum delay occurs on the Montgomery Street northbound approach followed by the McKinstry Avenue eastbound approach and Montgomery Street southbound approach. The Granby Road southwest bound approach at *Intersection 2* averages more than 37 seconds of delay per vehicle. While the *Fairfield Shopping Plaza* driveway approach experiences 140 seconds delay and operates at LOS F.

Both movements from the McKinstry Street approach and the left turn movement from the Montgomery Street northbound approach operate at LOS D. Delays at these approaches are greater than 50 seconds and these movements nearly approach LOS E. Also the traffic queue on the northbound approach of Montgomery Street at the *Intersection 2* during the peak hours is long and can extend beyond *Intersection 3*. This condition was duplicated in PVPC's analysis using the SimTraffic software. No significant back up traffic was observed to disrupt the traffic coordination of *Intersections 1 and 2*.

TURN LANE WARRANTS

The southwest bound approach of Granby Road at Intersection 2 experienced more than 37 seconds of delay. This approach has a median to separate right turning traffic but lacks a separate right turn lane. Presently, there are two undesignated lanes and left and right turning traffic share the lanes with the through traffic. A 6 second advance green phase is provided for this approach. An additional turn lane for this approach could help implement changes to the traffic signal phasing and timing which could in turn reduce delays for other approaches.

1. Left Turn Lane Warrant

The general criterion for an exclusive left turn lane warrant in Massachusetts is a minimum left turn volume of 100 or more vehicles per hour (*Massachusetts Highway Department Project Development and Design Guide 2006, Exhibit 6-23 B*). Approximately 60 to 80 vehicles make this left turn during the morning and afternoon peak hours. While an exclusive left turn lane for this approach is not warranted at this time. The left turn volumes indicate that it could be warranted in the future. It is recommended that the intersection be closely monitored to track fluctuations in traffic volumes and turning movements. The PVPC analyzed the intersection with as exclusive left turn lane for this approach. The total delay of this approach is reduced to 33 seconds in the morning peak hour and to about 30 seconds in the afternoon peak hour as a result of an exclusive left turn lane. The LOS improves from D to C in both the cases and LOS for other approaches does not change.

2. Right Turn Lane Warrant

The *Massachusetts Highway Department Project Development and Design Guide 2006* provides positive and negative criteria for exclusive right turn lane warrants in *Exhibit 6-24*. This information is shown in Table 5. A median separates the right turning traffic at this approach but an exclusive right turn lane does not exist. This can result in right turning traffic being blocked by the queue of through traffic at times. The total delay of this approach is again reduced to around 34 seconds in the morning peak hour and to about 31 seconds in the afternoon peak hour as a result of an exclusive right turn lane. The LOS improves from D to C for left and through movements and the right turn movement operates at LOS A. There is no major change in delay and LOS for all the other approaches.

III. RECOMMENDATIONS

Based on the field survey and analysis, the following short term recommendations have been made to improve transportation and safety conditions at the intersection.

PAVEMENT

Overall the pavement at the intersection is in poor condition. Several distress patterns have been observed on the Montgomery Street northwest bound approach. The right lane has pot holes and a drainage problem. Curbing along the edge of the pavement at this approach is damaged. It is recommended that the City of Chicopee initiate the necessary repair measures needed to maintain the quality of pavement and curbing.

The pavement markings on all the approaches were observed to be faded at the time of field study. Pavement arrows on Montgomery Street and Granby Road have also faded, and the crosswalk markings are not visible. It is recommended that the City of Chicopee re-paint all pavement markings at this intersection.

The driveway for the *Fairfield Shopping Plaza* is nearly 70 feet wide and does not have any pavement markings or curbing. The edge of the pavement is damaged in the vicinity of this intersection and also the movement of vehicles is not properly guided. It is recommended that the City of Chicopee contact the property owners to coordinate a plan to install the pavement markings and curbing in this area.

One of the side swipe crashes at the intersection involved a truck and an adjacent car both trying to turn at McKinstry Avenue approach. The travel lanes for each approach have width ranging from 11 to 13 feet. It is recommended that an engineering study be undertaken to check the suitability of the travel lane widths depending upon the traffic volume, percentage of heavy vehicles, and design speed.

SIGNALS

The green signal for right turning traffic from Montgomery Street in the northwest bound direction does not have signal visor. It is recommended that the City of Chicopee install a visor to reduce sun glare and improve visibility.

SIGNS

It was observed during the field visit that most of the signage at the intersection conforms to the Manual on Uniform Traffic Control Devices (MUTCD) guidelines. Some additional signage is required to further improve the safety conditions at the intersection.

The lane designation sign for the Montgomery Street northwest bound approach is placed after the intersection. In such cases drivers perceive the sign very late and the actual purpose of the sign is not served. Advance lane designation signs are recommended; preferably overhead signs above the lane, suspended on a mast arm. Research has shown overhead signs to be more effective and having higher visibility. A similar situation exists at the Granby Road approach at *Intersection 2* where again the lane designation sign is placed after the intersection. It is recommended the City of Chicopee consider mounting overhead lane designation signs in advance of all the approaches to the intersection.

Depending upon the findings of future engineering study, the crosswalk across Montgomery Street near *Fairfield Shopping Plaza* should be relocated / removed or highlighted by signs on both sides of the pavement for the traffic in either direction.

LEVEL OF SERVICE AND CONGESTION

The level of service at all approaches ranges from A to D although the delays for the McKinstry Avenue approach and left turns from Montgomery Street northbound approach are nearing LOS E conditions. Granby Road southwest bound approach at *Intersection 2* already has a median separating right turning traffic and there is a 6 second advance for this approach. Also the left turn volume at this approach during the morning peak hour is beginning to approach the requirements for an exclusive left turn lane warrant. It is recommended that the City considers an engineering study to review the exclusive turn lane